SERVICE MANUAL

Monochrome Video Monitors

ZVM-1240/1240-E/1240-EM

ZENITH | data systems

The purpose of this page is to make sure that all service bulletins are entered in this manual. When a service bulletin is received, mark the manual and list the information in the record below.

Record of Field Service Bulletins

SERVICE BULLETIN NUMBER	DATE OF ISSUE	CHANGED PAGE(S)	PURPOSE OF SERVICE BULLETIN	INITIALS

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Controls,Cables, and Indicators

The ZVM-1240 monochrome video monitor is designed to operate with a Zenith Z-100 Series or other personal computer. The monitor accepts four TTL-Level video signals (video input, highlight input, vertical sync, and horizontal sync) at the 9-pin D-type connector of its shielded signal cable. A micromesh anti-glare filter on an amber CRT provides viewing comfort (on the ZVM-1240-EM version only). The ZVM-1240 operates from 120 VAC and the ZVM-1240-E operates from 240 VAC.

The Z-239 Video card is required when operating the ZVM-1240 with a Zenith PC Series computer.

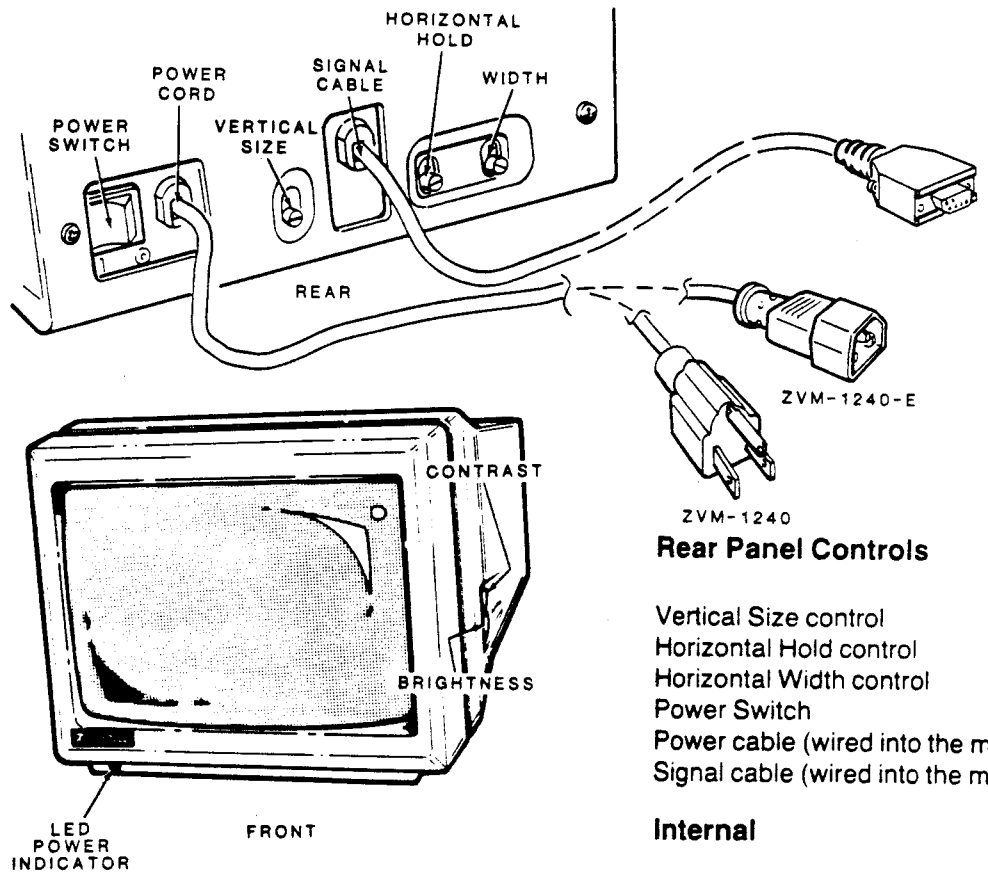


Figure 1
ZVM-1240 and ZVM-1240-E Monitors

Refer to Figure 1 for the locations of the following external controls, indicators, and cables. Refer to Figure 4 for the locations of the following internal adjustments.

Front Panel

Power indicator LED, green

Side Panel Controls

Contrast control (upper)
Brightness control (lower)

Rear Panel Controls

Vertical Size control
Horizontal Hold control
Horizontal Width control
Power Switch
Power cable (wired into the monitor)
Signal cable (wired into the monitor)

Internal

B+ Adjustment control
Master Brightness control
Focus control

Specifications

Electrical Power Requirements	108-132 VAC, 60Hz, 0.4A. (ZVM-1240). 216-264 VAC, 50Hz, 0.2A. (ZVM-1240-E). 35 Watts (both models).
CRT	12-inch (30 cm) diagonal, Amber (H-8), micromesh anti-glare filter, 12.7 kV anode voltage.
Input Signals (9-pin, D-type connector)	Video, TTL level. Highlight, TTL level. Horizontal sync, TTL level, (positive going). Vertical sync, TTL level, (negative going).
Maximum Characters/Line	80.
Maximum Rows of Characters	25.
Video Bandwidth	18 MHz.
Rise Time	20 ns.
Horizontal Frequency	18.432 kHz.
Vertical Frequency	49.82 Hz.
Vertical Retrace	750 µs.
Dimensions	10" (H) × 12.7" (W) × 11.8" (D). (25 × 32 × 30 cm).
Weight	12.9 lbs. (5.85kg).

NOTE: Zenith Data Systems reserves the right to discontinue products and to change specifications at any time.

Installation

1. Place the video monitor on a horizontal surface next to the computer and near an AC outlet.

CAUTION: The monitor must be located in an area that will provide proper ventilation. The air vents at the bottom, back, and top of the monitor must not be blocked.

2. Connect the video monitor signal cable between the computer and the video monitor.

3. Connect the video monitor power cable to the correct AC voltage.

4. Turn on the computer and the video monitor power switches. The power indicator on the front of the video monitor should light.

5. Use the BASIC program shown in Listing 1 to fill the screen with any character as follows:

   a. Enter the program shown in Listing 1 into the computer. You may want to save this program on a disk for later use.

   b. Run the program by typing **RUN** and pressing the **RETURN** key. The screen will be filled with the letter Z or any other character inserted in line 20.

   c. To end the program, press the **CTRL** and **BREAK** keys at the same time.

Listing 1
BASIC Program Used to Fill the Screen with a Character

```
10 FOR I=1 TO 2000
20 PRINT "Z";              'replace the "Z" with the
30 NEXT I                  'character of your choice
40 GO TO 40
```

6. Set the Contrast and Brightness controls fully clockwise.

7. As the CRT warms up, a raster should fill the screen.

8. Adjust the Contrast and Brightness controls as desired. The suggested sequence is:

   a. Set the contrast for a slight raster.
   b. Set the brightness to a level that is pleasant.
   c. Reset the contrast for a slight raster.

NOTE: Changes in room lighting or repositioning of the monitor screen may require resetting the brightness and contrast controls.

9. Adjust the Vertical Size and Width controls to fill the screen with raster.

10. Adjust the Horizontal Hold control to lock in the characters.

Circuit Description

Figure 2, a ZVM-1240 and ZVM-1240-E Block Diagram, is provided for tracing signal paths while studying circuit descriptions.

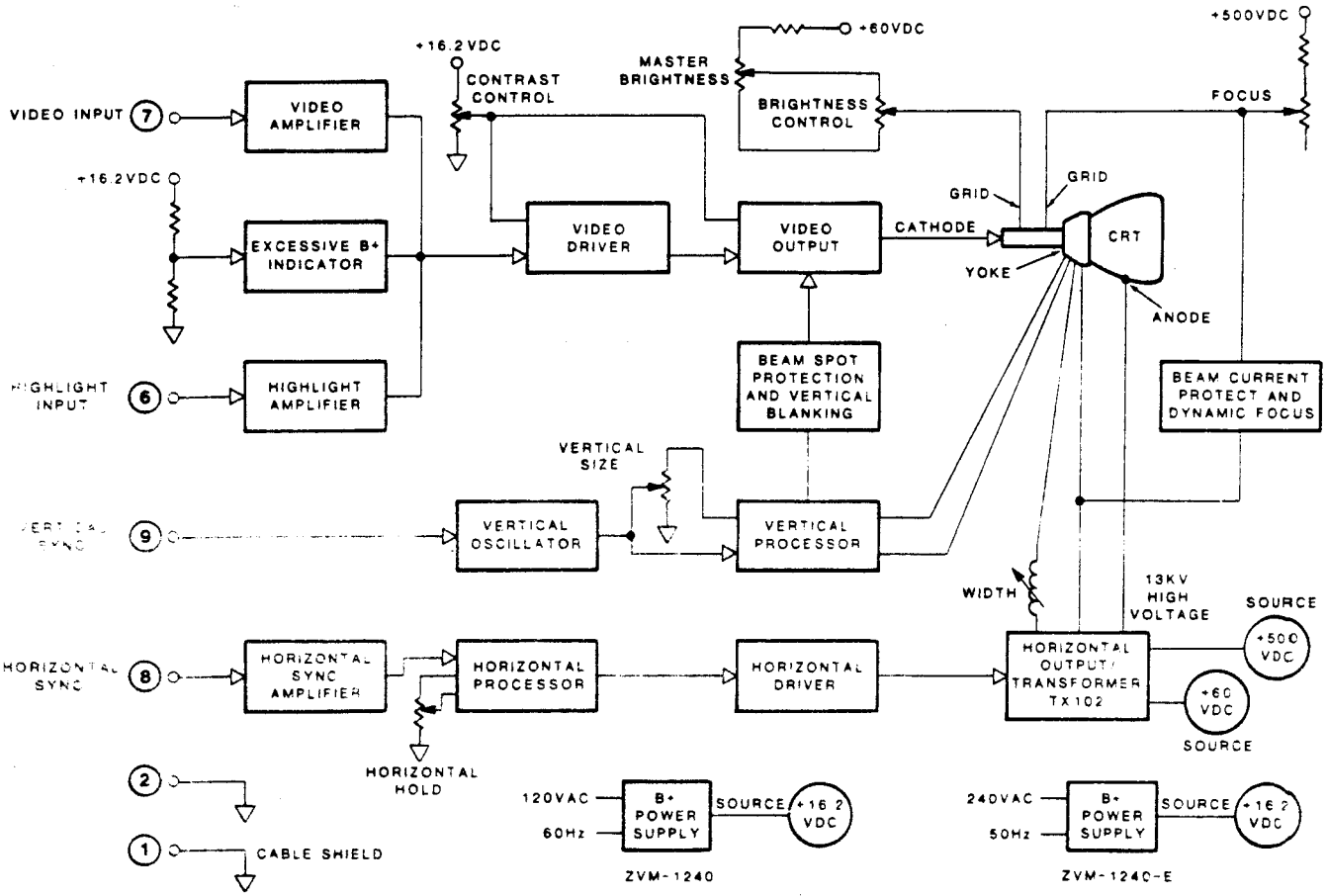


Figure 2
ZVM-1240 and ZVM-1240-E
Monitor Block Diagram

Refer to the following circuit descriptions for more information.

Power Supply

The following description is written for the ZVM-1240. The ZVM-1240-E operates similarly.

The full-wave bridge rectifier circuit comprised of diodes CRX501 through CRX504 rectify the AC voltage when power switch SX501 is closed. Capacitor CX507 develops approximately +155 VDC with 1.7 Vpp typical ripple (+335 VDC for the -1240-E and -1240-EM versions). CX508 and CX509 provide additional filtering. The DC potential of +155 volts is applied to pin 12 of transformer TX502. Resistors RX505 and RX510, and capacitor CX513 provide a self-starting bias circuit for transistor QX501.

When a voltage develops at the output of the bridge, the base of QX501 is driven positive, forcing the transistor into conduction. As a current path is established through QX501, pin 10 of TX502 approaches chassis ground potential. As current passes through the primary of TX502, pins 10 to 12, a magnetic field induces voltage into both secondary windings.

The voltage induced into the winding tied to the emitter of QX501 gradually goes positive until conduction through the transistor stops. When conduction stops, the field collapses and the collector-tuned circuit rings at a frequency determined by CX512 and the primary of TX502. This keeps QX501 reverse biased. When the sine-wave voltage at the collector of QX501 tries to go negative, it induces a negative voltage at pin 7 of TX502 and the transistor begins to conduct to saturation again.

The voltage induced into the winding, pin 1 to pin 2 of TX502 is rectified by CRX506 and filtered by CX511 to provide a +24 VDC input to the emitter of QX502. This transistor, along with QX503, QX504, and associated circuitry, form the power supply regulator. RX503 is the B+ adjustment and should be set for +16.2 VDC output. CRX505 is the power indicator.

High B+ Indicating Circuit

If the B+ voltage exceeds a certain level, an excessively high voltage can develop and result in damage to the monitor. Zener diode CR302 and associated components prevent the vertical sync pulses from being coupled through capacitor C316 if the excess voltage condition develops. The lack of sync pulses makes the monitor unusable.

Video and Highlight Driver Circuits

The video signal is fed through resistor R212 to the base of Q201, the video driver amplifier. The highlight input signal is fed through resistor R221 to the base of Q203, the highlight amplifier. These are TTL-level, positive-polarity input signals.

The two signals are amplified and inverted by Q201 and Q203 respectively. The signals are combined at the junction of R222 and Q201 collector. The Contrast control, R402, is connected to the base of Q204 to vary the bias voltage, thus controlling the signal current through Q204 and Q202. Q202, the video output amplifier, drives the cathode of the CRT, VX201.

Horizontal Sweep

The operation of the horizontal processor, IC101 (221-141-01), is the same as the 221-86-01, and they are interchangeable in the ZVM-1240 and ZVM-1240-E monitors. The integrated circuit has four distinct circuit configurations; phase detector, oscillator, regulator, and predriver.

Phase Detector—The phase detector is comprised of a differential amplifier and a gated current source. The current source is strobed by a negative sync signal that is AC coupled to pin 3 of IC101.

The current division of the two transistors of the differential amplifier is determined by the phase relationship between the sync and the sawtooth waveform on pin 4 of IC101. This sawtooth voltage is derived from positive horizontal flyback pulses. When the sync pulse and sawtooth voltage are in phase, the current division between the two transistors in the differential amplifier will be equal. When there is a phase difference, current will pass into or out of pin 5, which is connected by way of a low-pass filter to pin 7 of the oscillator. This current controls the oscillator.

Oscillator—The oscillator is an R-C type, with pin 7 being the control point. The timing capacitor, C101, is charged by the external resistor, R104, to a trip voltage set in the integrated circuit. When this trip voltage is reached, the capacitor discharges to a new trip value. This process is repeated, producing a sawtooth waveform at pin 7.

The output of the phase detector controls the oscillator through resistive coupling from pin 5 to pin 7. The horizontal hold control, R101 ,is also connected to pin 7. The two 100 kΩ resistors, R123 and R124, in the horizontal hold circuit are used to center the hold control range.

Regulator—The input to the regulator is at pin 6 of IC101. The regulator is temperature compensated and consists of two high-current diodes in series with a zener diode. The zener current is determined by an external resistor, R108, connected to the + 16.2-volt power supply. C102, CX103, and R108 also provide filtering.

Predriver—The predriver is a 4-transistor circuit, which takes the sawtooth voltage formed at pin 7 and produces a variable duty cycle waveform at pin 1. This output is fed to the base of Q101 after it is reduced by resistors R117 and R118. The "on time" of the output waveform is determined by the bias voltage on pin 8. This voltage is determined by a series of clip resistors; R106, R107, R109, R127, and R132, that match the integrated circuit to the monitor.

Horizontal Output

The signal from the horizontal output driver, Q101, is coupled to the base of Q102 through transformer TX101. Q102 controls the current in the primary winding of horizontal output transformer TX102 to switch scan current in yoke TX202B for right-side scan. C118 and the yoke inductance provide a resonant retrace pulse that resets the beam to the left side of the screen. Diode CR102 then provides scan for the left side of the screen. The current through the yoke establishes the magnetic field necessary to deflect the electron beam along a horizontal plane. The retrace pulse is also fed to TX102 where it is stepped up to provide high voltage for the CRT.

Vertical Sweep

The vertical circuit consists of: 1. A 2-transistor, free-running oscillator and 2. An IC power amplifier with retrace pulse generator.

Transistors Q301 and Q302 form a free-running oscillator. Sync pulses injected into the junction of resistors R302 and R303 lock the oscillator to the proper scan frequency. A DC reference level, which is determined by the voltage across resistor R306, is established across capacitor C303. The oscillator produces a sawtooth voltage which is superimposed on this DC level. The amplitude of the sawtooth voltage and, in turn, the vertical size of the CRT screen raster are set by resistors R309 and R311 and VERT SIZE control R312. The sawtooth voltage is fed to the noninverting input (pin 7) of power amplifier IC301. The amplified signal then drives yoke TX202A. The parabola voltage across yoke coupling capacitor CX306 is "S"-shaped by a network consisting of resistors R317 and R316 and capacitors CX309 and CX307. This signal is summed with the yoke current sample from R319 and fed back into the inverting input (pin 1) of IC301, providing linearity correction.

IC301 also contains a flyback generator which retraces the vertical scan current quickly without excessive power penalty. It also provides vertical retrace blanking from pin 3.

Spot Burn Protection

When the monitor is turned off, the filament of the CRT is still hot and capable of emitting electrons. With a high potential still on the face of the CRT, it is possible that a beam of electrons could be attracted to one particular area of the screen. If this occurs, the phosphor on the screen may be burned, leaving a light spot which is visible even after the filament has cooled and no current flow exists.

To prevent spot burn, capacitor CX124 charges to approximately 60 volts while the monitor is in use. When power is switched off, CX124 does not have a discharge path because the collector of Q202 represents a high impedance. The cathode of the CRT, pin 2, is therefore held positive, attracting the electrons from the hot filament and preventing them from striking the CRT. Diode CR108 is reverse biased, preventing CX124 from discharging through it.

Brightness

Adjustment of master brightness R142 changes the amount of voltage across the external brightness control, R143. R143 is used to vary the bias voltage on the grid of the CRT, pins 1 and 5. This voltage controls the acceleration of the electron beam and therefore controls the intensity of illumination.

Focus

Potentiometer R141 is used to adjust the bias voltage on the final grid of the CRT, pin 7. Changing this voltage will change the focus (clarity) of the raster displayed on the CRT. The +500-volt power supply provides voltage to pin 6 of the CRT and to focus control R141.

Dynamic Focus

A parabolic voltage is taken from C113 (yoke "S"-shaping capacitor), amplified by Q103, and combined with the DC focus voltage at the arm of focus control R141. This parabolic voltage compensates for the flat CRT by raising the focus voltage at the sides of the CRT, thus keeping the beam in focus as it sweeps across the entire face of the CRT.

Servicing

This section provides servicing information to assist in servicing and troubleshooting the monitor. Included are safety servicing guidelines, cleaning instructions, adjustments, inspection, testing, and troubleshooting.

Safety and Service Guidelines

WARNING: No work should be attempted on any part of the chassis by anyone not familiar with Zenith service procedures and precautions. Otherwise, personal injury may result.

WARNING: With the monitor power turned off and disconnected, discharge the high voltage anode lead at the CRT using a jumper lead connected between the chassis and a screwdriver (See Figure 14). Failure to comply could result in severe shock and/or personal injury.

WARNING: Do not operate a monitor with excessive high voltage because the monitor will produce x-rays from the CRT when the high voltage is excessive. Always verify that the high voltage is at the normal level when servicing the unit.

WARNING: Handle the cathode-ray tube carefully when you hold, remove, or install it. Otherwise, implosion and or injury may result.

NOTE: Under no circumstances should the original design be modified or altered without permission of Zenith Electronics Corporation.

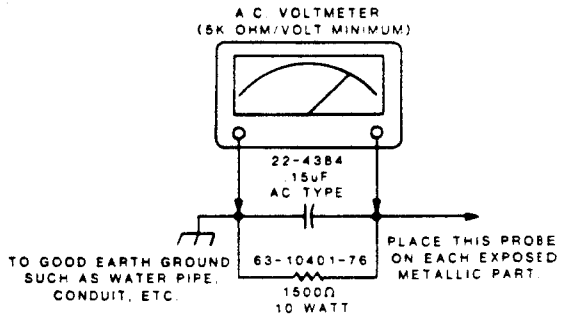


Figure 3
AC Leakage Voltmeter Circuit

AC LEAKAGE TEST

To prevent electrical shock after reassembly, perform an AC leakage test on all exposed metal parts of the monitor. Do not use a line isolation transformer to perform this test.

1. Connect the test circuit as shown in Figure 3.
2. With monitor power turned on, measure the leakage voltage between earth ground and an exposed monitor metal part.
3. Repeat the measurement with the meter leads reversed.
4. Repeat steps 2 and 3 until all exposed monitor metal parts are verified to have satisfactory AC leakage levels.

WARNING: Any leakage voltage measurement that exceeds 0.75 volts rms (0.5 milliamperes AC) constitutes a potential shock hazard and must be corrected.

CAUTION: Some of the integrated circuits (ICs) used in the monitor are electrostatic-sensitive devices (ESD). These devices can be damaged by static electricity. When handling any IC, use a wrist grounding strap or be sure to equalize the static charge before touching the IC.

OTHER PRECAUTIONS

- Be sure that all components are positioned in a way that does not cause short circuits.
- Inspect and correct all soldered connections for cold solder joints, frayed leads, damaged insulation, splashed solder, or sharp points.
- Never release a repaired product to a customer unless all protective devices, such as insulators, barriers, cover shields, strain reliefs, etc., have been reinstalled.
- Remove all loose material from inside the monitor after servicing.
- Follow the original lead layout, dress, lengths, and tension.
- Replace all components with exact Zenith replacement types.

Suggested Equipment and Supplies

TOOLS AND SUPPLIES

- 1/4" nut driver
- Standard screwdriver, 1/4" blade
- Phillips screwdriver, No. 1 tip
- Phillips screwdriver, No. 2 tip
- Diagonal cutters
- Wire strippers
- Long-nose pliers
- Desoldering tool
- Soldering iron, 25 to 40 watt
- Solder, 60/40, HE-331-13
- Desoldering braid, HE-490-185
- Cable ties, HE-354-59
- Lint-free cloths

TEST EQUIPMENT

- Oscilloscope — DC to 35 MHz, triggered sweep, with low capacitance (3 pF) probe.
- Digital voltmeter — High impedance input, zero to 1000 volts, zero to 1 megohm, Heath model SM-2215, or equivalent.

Troubleshooting

Use the following inspection to determine possible causes of monitor failures.

- Check for proper computer operation.
- Check monitor controls for proper response and settings.
- Unplug the signal and power cables from the monitor and check for burnt insulation, broken wires, or loose prongs on plugs.
- Check the AC receptacle (wall outlet) for the proper supply voltage.
- Check all cabling and internal circuit board plugs in the monitor for proper electrical connections.
- Check monitor adjustments as explained at the end of this section.
- Check all circuit boards in the monitor for broken or burnt components or for darkened areas or other signs of component overheating.

Table 1
General Troubleshooting

PROBLEM	POSSIBLE CAUSE
Monitor completely dead.	1. Power cord not connected. 2. Power switch not on. 3. Fuse is missing or blown. 4. Power supply failure. 5. Shorted horizontal output.
No video (Power Indicator is lit—High and Low voltages are OK).	1. Signal cable not connected to computer. 2. Contrast control set to low. 3. CRT socket board defective. 4. Main circuit board defective. 5. Wiring between boards defective. 6. No signal from the computer.
Insufficient brightness.	1. Brightness control set to low. 2. CRT socket board defective. 3. Main circuit board defective.
No raster.	1. Brightness control defective. 2. Horizontal circuit/high voltage not working. 3. CRT socket board defective. 4. CRT defective.
Characters on screen out of focus.	1. Focus control defective. 2. CRT socket board defective. 3. Main circuit board defective.
No horizontal sync.	1. Horizontal hold control defective. 2. Horizontal processor, IC101, defective.

Table 1 (continued)
General Troubleshooting

PROBLEM	POSSIBLE CAUSE
No vertical sync.	1. Vertical size control defective. 2. Vertical processor IC301 defective.
Vertical sweep scans bottom to top.	Red and blue wires reversed on deflection yoke.
Horizontal sweep scan right to left.	Yellow and black wires reversed on deflection yoke.

Table 2
Circuit Board Troubleshooting

PROBLEM	POSSIBLE CAUSE
No raster.	1. Q102, TX102 (check high voltage at CRT anode. 2. CR102, RX133, RX136. 3. Q101, Q102, TX101. 4. IC101. 5. VX201 CRT.
No video (Raster OK).	1. Q201, Q202, Q204. 2. VX201, R402 Contrast control. 3. CR103. 4. CRT socket. 5. Excessively high B+ voltage. High B+ will cause Q206 to conduct, killing the video signal.
No vertical deflection.	1. Q301, Q302. 2. IC301. 3. TX202A, yoke. 4. CR301.
No vertical sync.	CR302, Q301, Q302, R323, R326, C312, C316.

Table 2 (continued)
Circuit Board Troubleshooting

PROBLEM	POSSIBLE CAUSE
Vertical sweep off frequency.	IC301.
No horizontal sync.	1. Q404 and circuit components. 2. IC101. 3. R101 Horizontal Hold control, CX104.
Horizontal sync off frequency.	1. IC101.
Poor horizontal linearity or foldover.	1. TX102, LX101, LX102, CR106. 2. TX202B, yoke. 3. Q106, Q101, Q102.
Narrow horizontal raster.	1. Q102, TX101. 2. LX102, CR106.
Characters out of focus.	1. CR107, RX136, C122. 2. R141 Focus control. 3. Q103 and circuit components.
Only top or bottom of vertical deflection.	1. IC301. 2. Vertical deflection yoke TX202A open.
No high voltage on CRT.	1. Q106, Q101, Q102. 2. Yoke TX202B winding open. 3. Flyback transformer TX102. 4. CR102.
No video.	1. Q201, Q202, Q204, L201 open. 2. Signal cable defective.

Adjustments

Use a computer to provide signals for the following adjustments.

B+ (+16.2 V) VOLTAGE

NOTE: This adjustment may interact with the focus adjustment.

1. Switch off the monitor power and disconnect it from facility power.
2. Remove the back cover and reconnect the cables.
3. Locate the B+ adjustment, RX503 (See Figure 4).
4. Connect a Heath SM-2215 or equivalent DVM between any B+ point and chassis ground.
5. Adjust the B+ adjustment for +16.2 volts.

FOCUS

NOTE: CRT yoke adjustment may interact with the focus adjustment.

1. Turn off the monitor power and disconnect it from facility power.
2. Remove the back cover and reconnect the cables.
3. Locate the focus adjustment, R141 (See Figure 4).
4. Set the contrast and brightness controls to normal levels with characters displayed.
5. Adjust the focus adjustment for the clearest, sharpest display.

CRT YOKE

NOTES:

1. These adjustments may interact with the focus adjustment.

2. Do not overtighten the yoke clamp.

3. Make sure the yoke is positioned as far forward on the CRT as possible. If necessary, unclamp the yoke; then slide it forward, and reclamp.

Positioning

1. Loosen the clamp screw and rotate the deflection yoke until the edges of the display are parallel with the edges of the screen; then tighten the clamp screw.

2. Adjust the centering rings so that the display is centered on the screen.

Linearity

Remove the ferrite foam magnets that may be installed on the yoke.

2. Select the most nonlinear of the four displayed edges and install a ferrite magnet on the yoke post nearest the greatest distortion.

3. Repeat step 2 as necessary, around the yoke, until a uniform rectangular shape is displayed.

NOTE: If only a small change in linearity is needed, reduce the size of the ferrite magnets by cutting off a small portion with diagonal cutters.

Cleaning Procedures

WARNING: Be sure that the monitor's power cable is unplugged before you clean the monitor.

- Clean the cabinet with a lint-free cloth, mildly dampened with a nondetergent cleaning solution; do not spray liquids directly on the monitor or use a wet, saturated cloth.

- Clean dust from the monitor's screen with a lint-free cloth.

- Clean heavy dirt from the monitor's screen with a swab soaked with isopropyl alcohol.

- Be sure the monitor is completely dry before applying electrical power.

Servicing Diagrams

Component location drawings, waveform photographs, and schematic diagrams are provided along with Table 3, B + Supply Transistor Voltages.

The circuit location of each waveform is indicated on both the schematic and the component location drawing. A Z-160 PC Series computer with color bar output was used to supply signals for generating the waveforms. Refer to "Waveform Photograph Explanations" at the back of the manual.

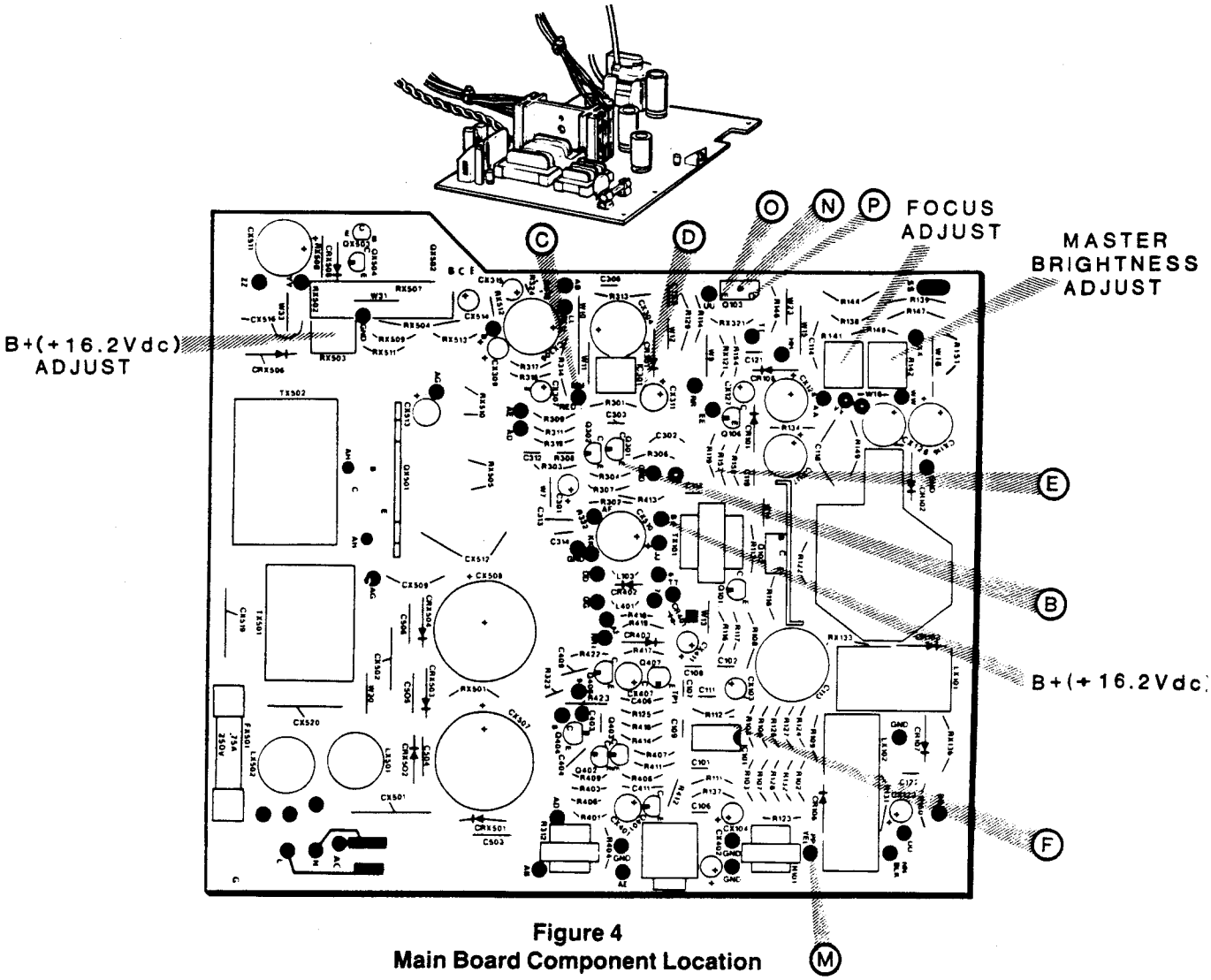
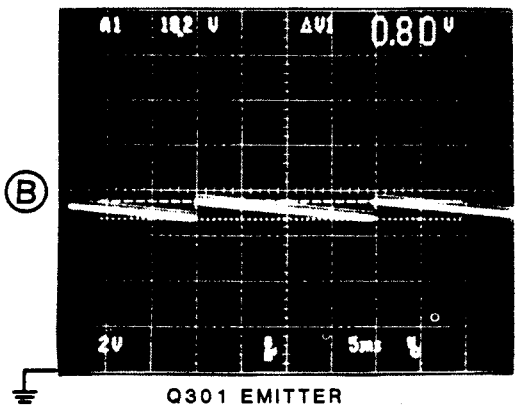
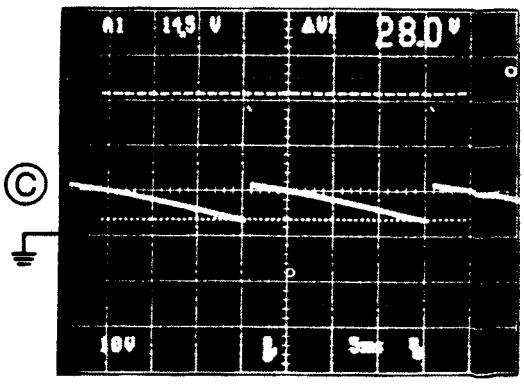


Figure 4
Main Board Component Location



Q301 EMITTER



IC301 PIN 5
(RED LEAD AT YOKE)

TRANSISTOR				
LOCATION	QX501	QX502	QX503	QX504
B	-2.00	+22.45	+.616	+2.41
E	0.00	+23.07	+20.20	+2.90
C	+157.6	+16.20	+00.02	+0.616

B+16.2 VDC
(B+ WITH FULL CONTRAST & BRIGHTNESS=+16.06)
(B+ WITH MINIMUM CONTRAST & BRIGHTNESS=+16.23)

Table 3
B+ Supply Transistor Voltages

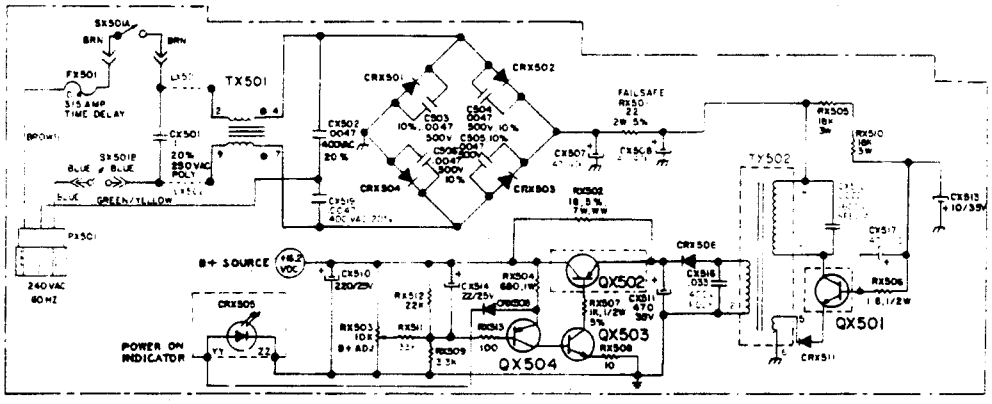
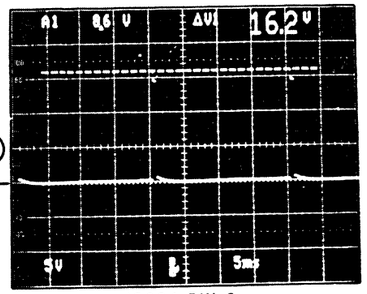
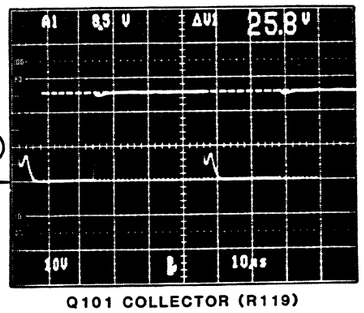


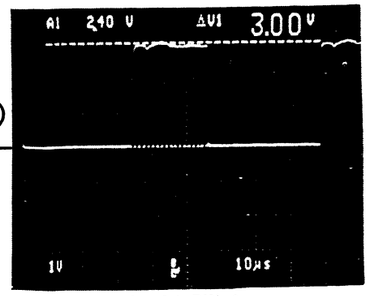
Figure 10
B+ Supply Schematic – ZVM-1240-E



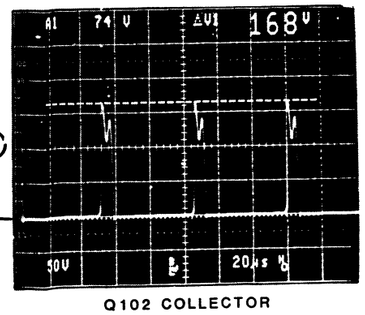
IC301 PIN 3
(CX311 NEGATIVE TERMINAL)



Q101 COLLECTOR (R119)

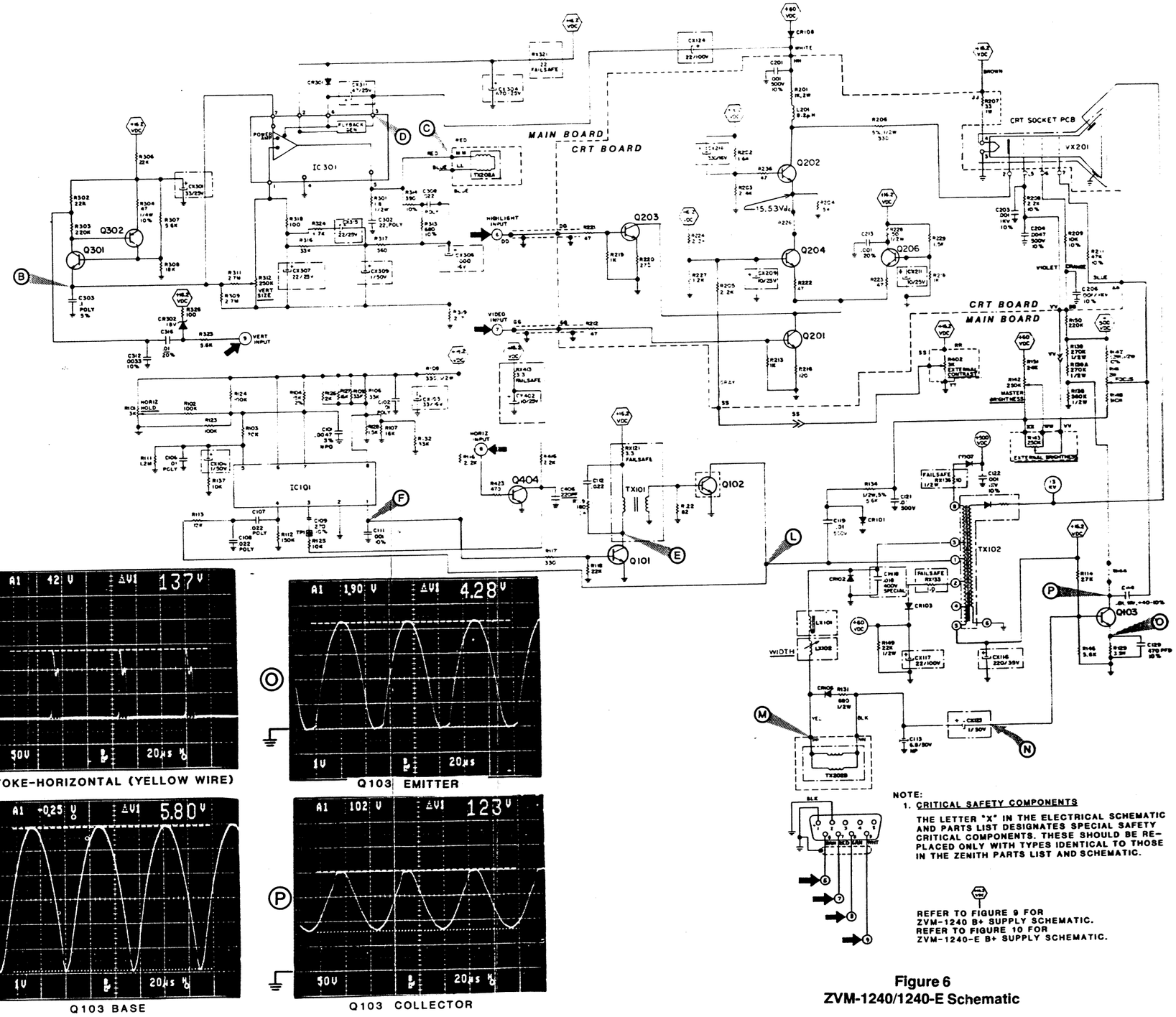


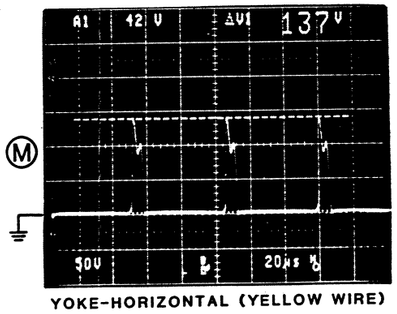
IC 101 PIN 1



Q102 COLLECTOR

Figure 5
Main Board Waveforms





YOKE-HORIZONTAL (YELLOW WIRE)

Q103 EMITTER

Q103 BASE

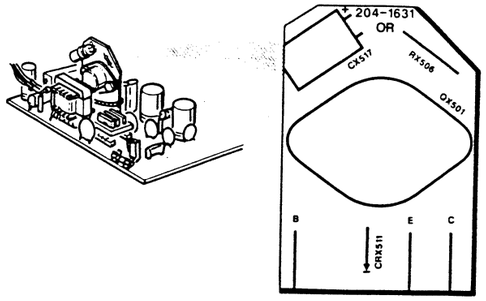
Q103 COLLECTOR

NOTE:
1. CRITICAL SAFETY COMPONENTS

THE LETTER "X" IN THE ELECTRICAL SCHEMATIC AND PARTS LIST DESIGNATES SPECIAL SAFETY CRITICAL COMPONENTS. THESE SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ZENITH PARTS LIST AND SCHEMATIC.

REFER TO FIGURE 9 FOR ZVM-1240 B+ SUPPLY SCHEMATIC.
REFER TO FIGURE 10 FOR ZVM-1240-E B+ SUPPLY SCHEMATIC.

Figure 6
ZVM-1240/1240-E Schematic



REGULATOR BOARD
(ZVM-1240-E ONLY)

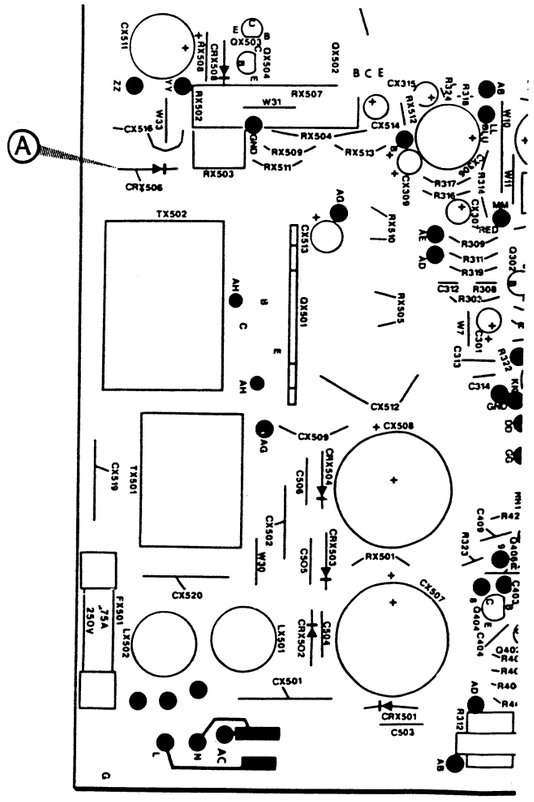


Figure 7
B+ Supply Component Location

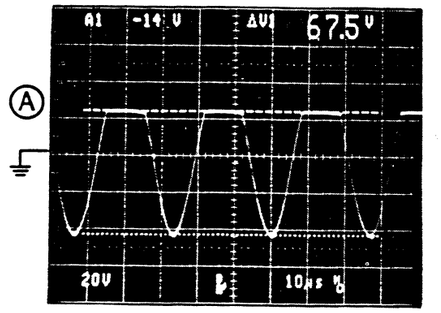
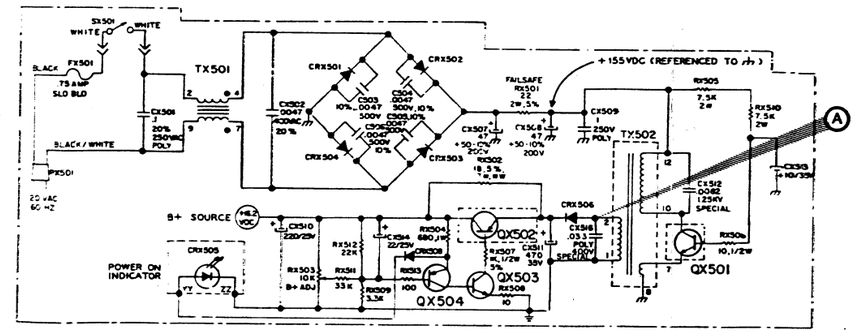


Figure 8
Waveform – Anode of CRX506



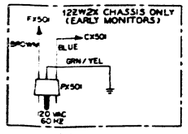
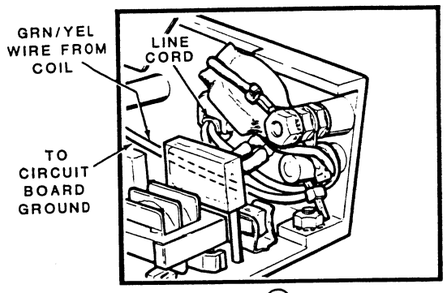
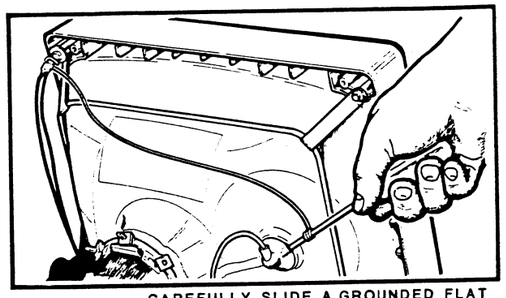
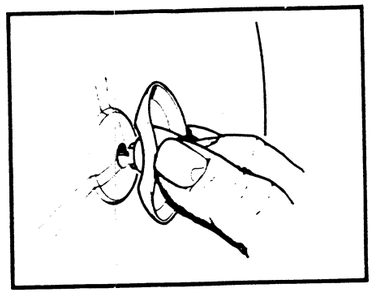


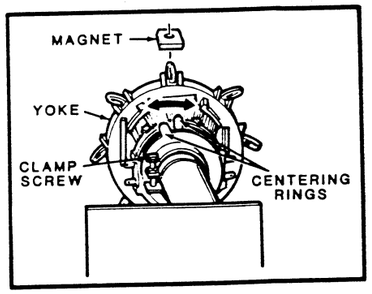
Figure 9
B+ Supply Schematic – ZVM-1240





CAREFULLY SLIDE A GROUNDED FLAT SCREWDRIVER TIP UNDER THE LIP OF THE ANODE LEAD.





WARNING
DISCHARGE HIGH VOLTAGE BEFORE ATTEMPTING LEAD REMOVAL

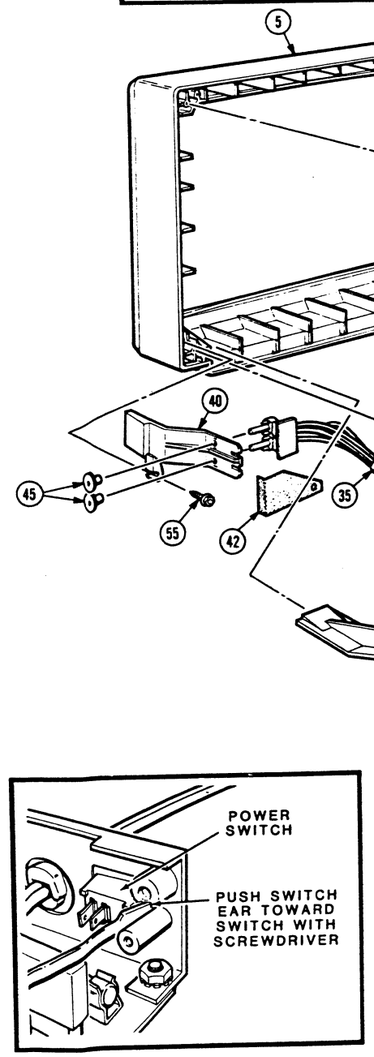


Figure 14
ZVM-1240/1240-E Exploded View

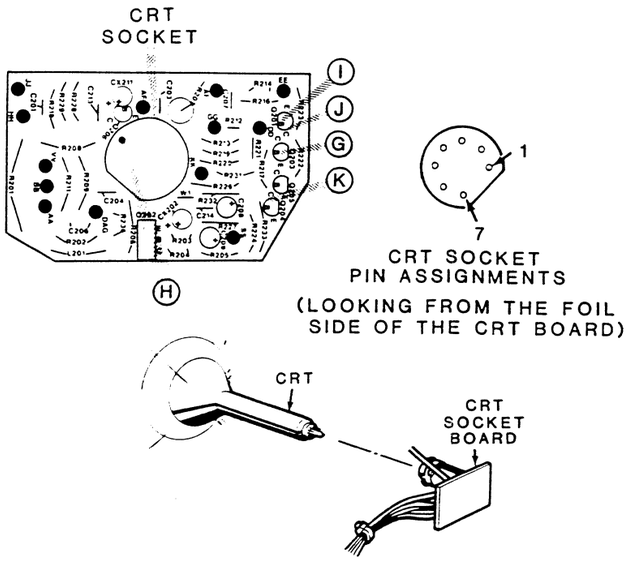
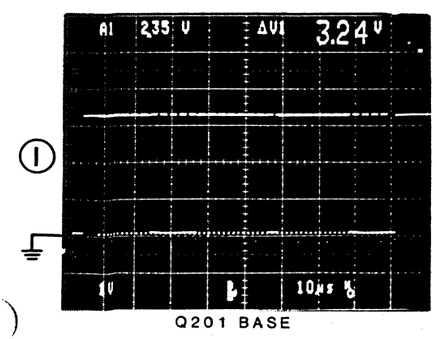


Figure 11
CRT Board Component Location



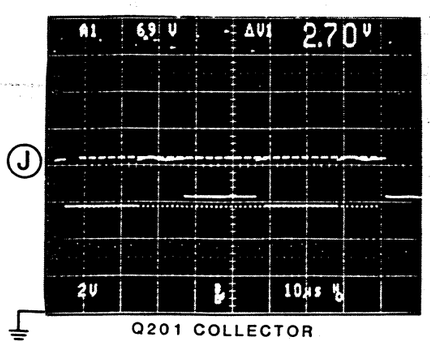
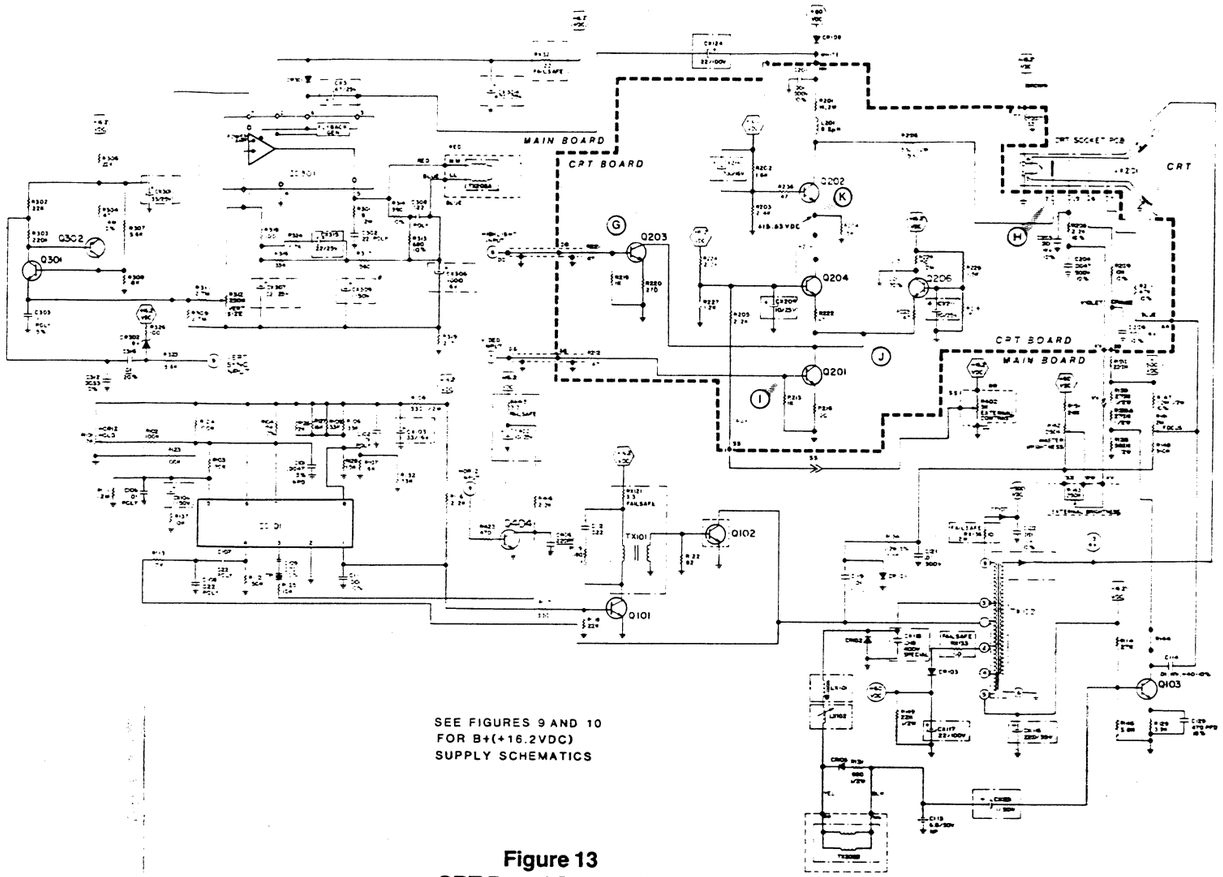
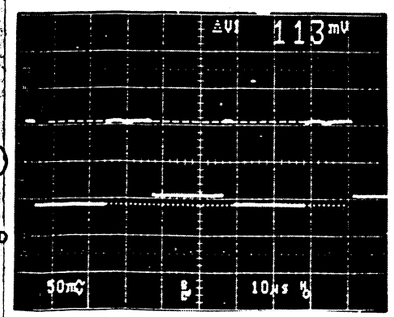


Figure 12
CRT Board Waveforms



SEE FIGURES 9 AND 10
FOR B+(+16.2VDC)
SUPPLY SCHEMATICS

Figure 13
CRT Board Schematic



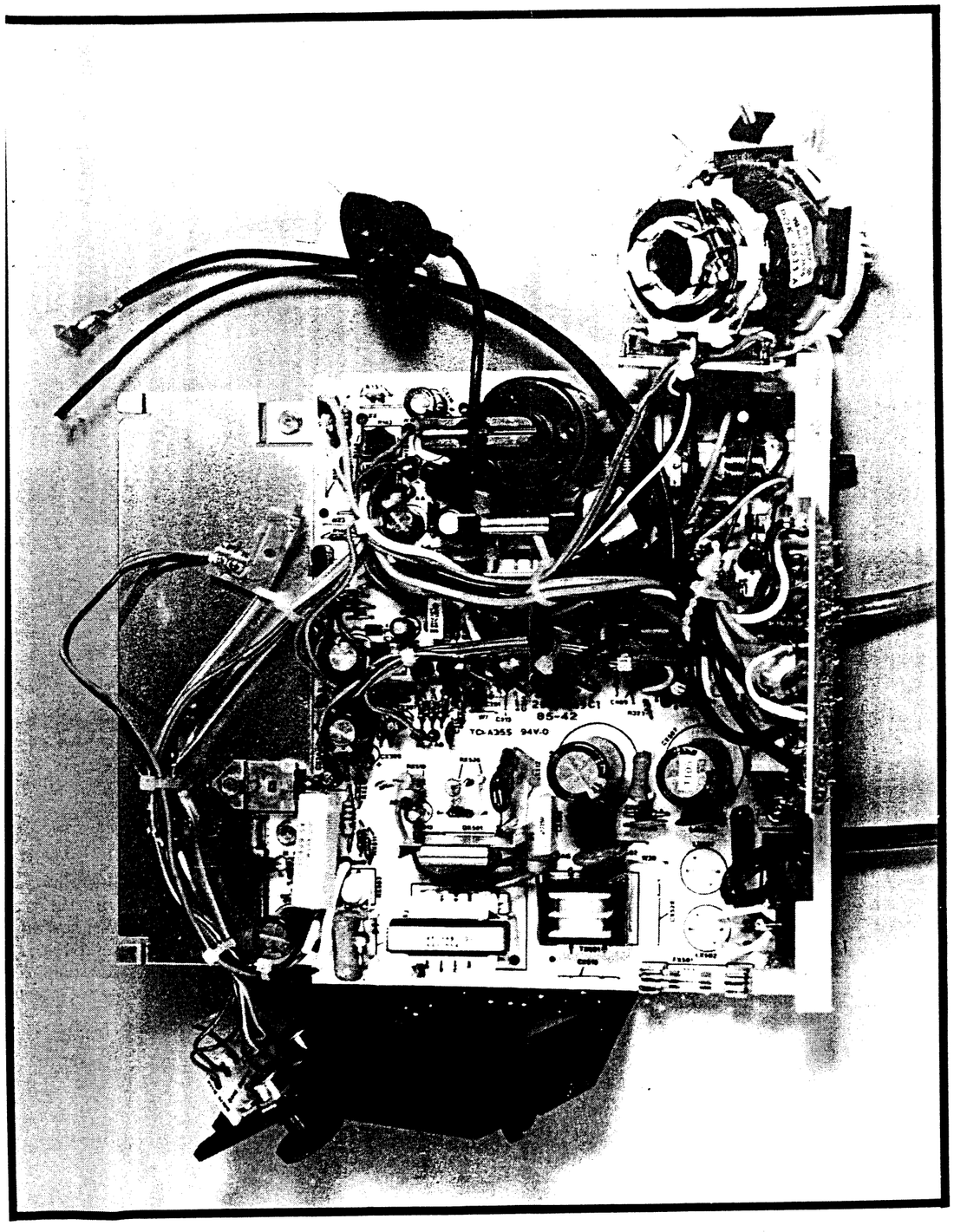


Figure 15
ZVM-1240/1240-E Lead Dressing

4. Disconnect the black ground lead from under the CRT ground contact (20).

5. Place the monitor face down on a flat surface and remove the power LED board (60).

6. Carefully slide the main board (80) toward the rear and out of the guide rails.

The main board (80) is now free for inspection and service. Wires will have to be unsoldered to free the main board from the monitor.

CONTROL MOUNTING BRACKET (40)

1. Remove the back cover (130).

2. Remove the nut (55) that secures the bracket to the front panel (5).

3. Carefully slide the bracket (40) to the rear and out of the guide in the front panel.

The control mounting bracket is now free for inspection and service. Wires will have to be unsoldered to free the control mounting bracket from the monitor.

Power Switch (110)

1. Switch off monitor power and disconnect the power cable.

2. Use a flat bladed screwdriver to carefully pry the ON/OFF switch out of the rear control panel. Alternately pry from side to side until the switch is loose. Refer to the inset drawing in Figure 14.

CRT (10)

1. Remove the rear cover (130).

2. Remove the CRT board (125).

3. Remove the control mounting bracket (40).

4. Place the monitor face-down on a soft surface.

5. Discharge the high voltage and disconnect the high voltage lead from the CRT.

WARNING: Discharge the high voltage at the anode lead of the CRT using a jumper lead connected between the chassis and a screwdriver. Otherwise, shock or injury may result. Refer to the inset drawing in Figure 14.

6. Remove the main board (80).

7. Loosen the yoke clamp and remove the yoke (30) from the CRT (10).

8. Remove the four screws (11) that secure the CRT (10) to the front panel (5) and lift out the CRT.

LEAD DRESSING

Whenever you service this monitor, proper lead dress is critical in order to maintain compliance with UL safety requirements. Clearance between primary and secondary voltage leads must be at least 8 mm or 5/16". The photograph in Figure 15 shows proper lead dressing for the monitor chassis.

Disassembly/ Reassembly

This section, along with Figure 14, provides instructions for both disassembling and reassembling the ZVM-1240/-1240-E monitors. The numbers in the parentheses e. g. (130) are reference descriptions given in Figure 14. The step-by-step instructions are written for disassembly. For reassembly, perform the steps in the reverse order except when instructed otherwise.

WARNING: Be sure the signal and power cables are unplugged from the computer or other signal or power sources before disassembling the monitor.

Normally, the disassembly sequence will be:

1. Remove the back cover (130).
2. Remove the side panel control board (40).
3. Remove the CRT board (125).
4. Remove the main board (180).
5. Remove the cathode-ray tube (10).

NOTE: Some of the assemblies can be removed independently of the others; therefore, see each procedure.

BACK COVER (130)

WARNING: The CRT and the attached CRT board loses support once the back cover (130) is removed. Extra care is then required during repositioning the monitor. Turn the power off and disconnect the power cord before attempting to reposition the monitor.

1. Switch off the monitor power and disconnect the power cable from facility power.
2. Disconnect the video cable connector from the computer.
3. Remove the seven screws (135) shown in Figure 14.
4. Carefully slide the back cover (130) from the monitor.

CRT BOARD (125)

1. Remove the back cover (130).
2. Loosen the clamp that secures the CRT board (125) to the neck of the CRT (10).
3. Cut the cable ties (35) that secure the wires leading to the CRT board (125).
4. Disconnect the black lead from the CRT ground contact (20).
5. Use one hand to raise the neck of the CRT and carefully slide the CRT board to the rear until the CRT pins are disengaged and the clamp is free from the CRT.

The CRT board is now free for inspection and service. Wires will have to be unsoldered to free the CRT board from the monitor.

MAIN BOARD (80)

1. Remove the back cover (130).
2. Remove the CRT board (125).
3. Discharge the high voltage and disconnect the high voltage lead from the CRT.

WARNING: Discharge the high voltage at the anode lead of the CRT, using a jumper lead connected between the chassis and a screwdriver. Otherwise, shock or injury may result. Refer to the inset drawing in Figure 14.

Parts Lists

CAUTION: Some of the integrated circuits (ICs) used in this unit are electrostatic-sensitive devices. When handling any IC, use a wrist ground strap or be sure to equalize the static charge before touching the IC.

IMPORTANT SAFETY NOTICE: Under no circumstances should the original design be modified or altered without permission from Zenith Electronics Corporation. All components should be replaced only with types identical to those in the original circuit, and their physical location, wiring, and lead dress must conform to the original layout upon completion of repairs.

In some instances, redundant circuitry is incorporated for additional circuit protection and x-ray radiation protection. Special circuits are also used to prevent shock and fire hazard. **These special circuit components, which are indicated by an X in the Reference Designator column, must be replaced with identical components only.**

NOTE: Unless otherwise specified, all resistors are 1/4-watt, 5% tolerance.

In the following parts lists, N/A refers to "not assigned," parts for which there is no replacement part number assigned.

Table 4
Major Assemblies (Refer to Figure 14)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
5	14-11683	Cabinet front
10	100-00761-29	CRT, 12-inch, amber
N/A	A-13874	Anti-glare filter for 100-00761-29
11	114-01150-03	Screw, 8-18 × 1.00", hex head
12	19-01080-03	CRT retaining clamp

Table 4 (continued)
Major Assemblies (Refer to Figure 14)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
N/A	114-01017-01	Screw for 19-01080-03
N/A	93-02030-02	Washer for 19-01080-03
N/A	54-00242-01	Nut for 19-01080-03
15	12-08934-01	CRT bracket
N/A	12-09268-01	CRT bracket (Installs under 12-08934-01)
20	127-00277	CRT ground contact
30	95-03397-07	Deflection yoke
N/A	A-13287	Clamp assembly, deflection yoke
N/A	83-08066	Tie strap, 6-inch (for A-13287)
35	19-00733-01	Cable retainer, wire tie
40	12-08939	Bracket, control mounting
42	194-01579	Insulating strip
45	46-10296-03	Knob, push button
50	149-464	Foam magnet
55	112-02143-02	Screw, 8-18 × 0.500" phillips
60	N/A	Power indicator LED
61	112-02099-04	Screw, THD form, 6-20 × 0.312", pan head, phillips
62	93-02024-02	Flat washer
70	12-08940-02	Bracket, pc boardguide left
75	12-08940-03	Bracket, pc boardguide right
80	12ZW4X	Chassis assembly (ZVM-1240)
80	12ZW14X	Chassis assembly (ZVM-1240-E)
85	112-01717-01	Screw, 6-32 × 0.375" phillips
86	71-00139-03	Screw, 8-32 × 1.00", flat HD, phillips
87	54-00242-01	Nut 8-32 × 0.343" AF × 0.125, hex
90	12-08933-01	Plastic bracket (ZVM-1240)
90	12-08933-03	Plastic bracket (ZVM-1240-E)
95	76-02172-01	Shaft, tuning
100	11-00325-11	Power cord (ZVM-1240)
101	11-00385-11	Power cord (ZVM-1240-E)

Table 4 (continued)

Major Assemblies (Refer to Figure 14)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
105	125-00198-03	Strain relief (ZVM-1240)
105	125-00198-19	Strain relief (ZVM-1240-E)
106	52-02550-01	Signal cable
107	125-00198-22	Strain relief
110	85-01708	Power switch (ZVM-1240)
110	85-01687	Power switch (ZVM-1240-E)
111	149-00535	Ferrite core (power cable)
N/A	149-00535	Ferrite core (signal cable
120	54-00347	Nut, 6-32 × 0.312"
125	N/A	CRT card
130	14-11684-01	Cabinet rear
135	112-01628-02	Screw, 8-18 × 0.625" phillips
140	166-00269-01	Bumper foot
145	76-02172	Shaft, tuning

Table 5

Electronic Components
(Refer to Figures 4, 7, and 11)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
CAPACITORS		
C101	22-07759-09	4700 pF ceramic
C102	22-07774-12	.01 μF polyester
CX103	22-07859-07	33 μF, 16 V, electrolytic
CX104	22-07862-01	1 μF, 50 V, electrolytic
C106	22-07774-12	.01 μF polyester
C107	22-07774-16	.022 μF polyester
C108	22-07774-16	.022 μF polyester
C109	22-07613-04	220 pF ceramic
C111	22-07613-12	1000 pF ceramic
C112	22-07615-08	.022 μF ceramic
C113	22-07892-04	6.8 μF, 50 V, electrolytic, nonpolarized
C114	22-03512	.01 μF ceramic
CX116	22-07861-10	220 μF, 35 V, electrolytic
CX117	22-07864-06	22 μF, 100 V, electrolytic
CX118	22-07798-03	.018 μF polypropylene

Table 5 (continued)

Electronic Components
(Refer to Figures 4, 7, and 11)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
Capacitors (Cont'd.)		
C119	22-04905-01	.01 μF ceramic
C121	22-04905-01	.01 μF ceramic
C122	22-07811	1000 pF ceramic
CX123	22-07862-01	1 μF, 50 V, electrolytic
CX124	22-07864-06	22 μF, 100 V, electrolytic
C129	22-07614-14	1500 pF ceramic
C201	22-07241	.001 μF ceramic
CX202	22-07860-05	10 μF, 25 V, electrolytic
C203	22-07811	1000 pF ceramic
C204	22-07440	.0047 μF ceramic
C206	22-07811	1000 pF ceramic
CX208	22-07860-08	47 μF, 25 V, electrolytic
CX209	22-07860-05	10 μF, 25 V, electrolytic
CX211	22-07860-05	10 μF, 25 V, electrolytic
C213	22-07614-12	1000 pF ceramic
CX216	22-07859-11	330 μF, 16 V, electrolytic
CX301	22-07860-07	33 μF, 25 V, electrolytic
C302	22-7563-28	.22 μF polyester
C303	22-08004-02	.1 μF polyester
CX304	22-07860-12	470 μF, 25 V, electrolytic
CX306	22-07859-13	1000 μF, 16 V, electrolytic
CX307	22-07860-06	22 μF, 25 V, electrolytic
C308	22-07774-16	.022 μF polyester
CX309	22-07862-01	1 μF, 50 V, electrolytic
CX311	22-07860-08	47 μF, 25 V, electrolytic
C312	22-07613-18	3300 pF ceramic
CX315	22-07860-06	22 μF, 25 V, electrolytic
C316	22-07802-07	.01 μF ceramic tubular
CX402	22-07860-05	10 μF, 25 V, electrolytic
C406	22-07742-02	220 pF, ceramic, tubular
CX501	22-07867	.1 μF polyester
CX502	22-07889	.0047 μF ceramic
C503	22-07440	.0047 μF ceramic
C504	22-07440	.0047 μF ceramic
C505	22-07440	.0047 μF ceramic
C506	22-07440	.0047 μF ceramic
CX507	22-07909	47 μF, 200 V, electrolytic (ZVM-1240)

Table 5 (continued)
Electronic Components
(Refer to Figures 4, 7, and 11)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
Capacitors (Cont'd.)		
CX507	22-08062	47 µF, 400 V, electrolytic (ZVM-1240-E)
CX508	22-07909	47 µF, 200 V, electrolytic (ZVM-1240)
CX508	22-08062	47 µF, 400 V, electrolytic (ZVM-1240-E)
CX509	22-07566-24	.1 µF polyester (ZVM-1240)
CX510	22-07860-10	220 µF, 25 V, electrolytic
CX511	22-07861-12	470 µF, 35 V, electrolytic
CX512	22-08008-11	.0082 µF, polypropylene (ZVM-1240)
CX512	22-07672-23	.0022 µF, polypropylene (ZVM-1240-E)
CX513	22-07861-05	10 µF, 25 V, electrolytic
CX514	22-07860-06	22 µF, 25 V, electrolytic
CX516	22-07798-06	.033 µF polypropylene
CX517	22-07858-12	470 µF, 10 V, electrolytic (ZVM-1240-E)
CX519	22-07889	.0047 µF ceramic (ZVM-1240-E)
DIODES		
CR101	103-00295-03	Low voltage, general
CR102	103-00298-03	Low voltage, general
CR103	103-00323-03	Low voltage, general
CR106	103-00323-03	Low voltage, general
CR107	103-00323-04	Low voltage, general
CR108	103-00254-01	Low voltage, general
CR301	103-00254-01	Low voltage, general
CR302	103-00279-27	Zener diode, 18 V, 0.5 watt
CR303	103-00142-01	Low voltage, general
CRX501	103-00254-01	Low voltage, general (ZVM-1240)
CRX501	103-00315-06	Low voltage, general (ZVM-1240-E)
CRX502	103-00254-01	Low voltage, general (ZVM-1240)
CRX502	103-00315-06	Low voltage, general (ZVM-1240-E)

Table 5 (continued)
Electronic Components
(Refer to Figures 4, 7, and 11)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
Diodes (Cont'd.)		
CRX503	103-00254-01	Low voltage, general (ZVM-1240)
CRX503	103-00315-06	Low Voltage, general (ZVM-1240-E)
CRX504	103-00254-01	Low voltage, general (ZVM-1240)
CRX504	103-00315-06	Low voltage, general (ZVM-1240-E)
CRX505	103-00385-04	LED, green
CRX506	103-00339-04	Low voltage, general
CRX508	103-00142-01	Low voltage, general
CRX511	103-00323-02	Low voltage, general (ZVM-1240-E)
FUSE		
FX501	136-00116-17	.75 amp, SLO BLO, 250 volts (ZVM-1240)
FX501	136-00133-11	.4 amp, SLO BLO, 250 volts (ZVM-1240-E)
N/A	19-00982	Fuse clip
INTEGRATED CIRCUITS		
IC101	221-00141-01	Horizontal processor
IC301	221-00347-01	Vertical output
INDUCTORS		
LX101	20-03945-03	RCF coil, tunable, linearity
LX102	20-04148	RCF coil, tunable, width control
L201	20-03907-11	RCF coil, 8.2 µH
TRANSISTORS		
Q101	121-00819	NPN, Horizontal driver
Q102	121-01039	NPN Transistor
	126-02096	Heat sink for Q102
Q103	121-01058	NPN, Dynamic focus
Q201	121-00895	NPN, Video amplifier

Table 5 (continued)
Electronic Components
(Refer to Figures 4, 7, and 11)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
Transistors (Cont'd.)		
Q202	121-01058	NPN, Video output
Q203	121-00895	NPN, Highlight amplifier
Q204	121-00895	NPN
Q206	121-00895	NPN
Q301	121-00975	NPN, Vertical oscillator
Q302	121-00699	PNP, Vertical oscillator
Q404	121-00895	NPN, Sync amplifier/separator
QX501	121-01142	NPN Switching (ZVM-1240) Power oscillator
	126-02391-02	Heat sink for QX501
QX501	121-01029-01	NPN Switching (ZVM-1240-E)
QX502	121-00994	PNP
	126-02448	Heat sink for QX502
	19-00954	Clamp for QX502
	114-00803-09	Screw for QX502
	194-00531	Insulating strip for QX502
QX503	121-01035	NPN, Power supply regulator
QX504	121-00699	PNP, Power supply regulator
RESISTORS		
R101	63-09228-05	3 kΩ, control (horizontal hold)
R102	63-10236-20	100 kΩ, 1/4-watt, 5%
R103	63-10236-22	120 kΩ, 1/4-watt, 5%
R104	63-10234	15 kΩ, 1/4-watt, 2%
R106	61-10236-08	33 kΩ, /4-watt, 5%
R107	63-10236-01	16 kΩ, /4-watt, 5%
R108	63-10243-60	330 Ω, 1/2-watt, 5%
R109	63-10236-08	33 kΩ, 1/4-watt, 5%
R111	63-10236-46	1.2 MΩ, 1/4-watt, 5%
R112	63-10236-24	150 kΩ, 1/4-watt, 5%
R113	63-10235-98	12 kΩ, 1/4-watt, 5%
R114	63-10236-06	27 kΩ, 1/4-watt, 5%
R116	63-10235-80	2.2 kΩ, 1/4-watt, 5%
R117	63-10235-60	330 Ω, 1/4-watt, 5%
R118	63-10236-04	22 kΩ, 1/4-watt 5%

Table 5 (continued)
Electronic Components
(Refer to Figures 4, 7, and 11)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
Resistors (Cont'd.)		
R119	63-10243-54	180 Ω, 1/2-watt, 5%
RX121	63-10559-12	3.3 Ω, 1/4-watt, 5%
R122	63-10235-46	82 Ω, 1/4-watt, 5%
R123	63-10236-20	100 kΩ, 1/4-watt, 5%
R124	63-10236-20	100 kΩ, 1/4-watt, 5%
R125	63-10235-96	10 kΩ, 1/4-watt, 5%
R126	63-10235-79	2 kΩ, 1/4-watt, 5%
R127	63-10236-01	16 kΩ, 1/4-watt, 5%
R128	63-10235-76	1.5 kΩ, 1/4-watt, 5%
R129	63-10235-86	3.9 kΩ, 1/4-watt, 5%
R131	63-10243-68	680 Ω, 1/2-watt, 5%
R132	63-10236-08	33 kΩ, 1/4-watt, 5%
RX133	63-10559	1 Ω, 1/4-watt, 5%
R134	63-07816	5.6 kΩ, 1/2-watt, 5%
RX136	63-10565-24	10 Ω, 1/2-watt, 5%
R137	63-10235-96	10 kΩ, 1/4-watt, 5%
R138	63-10244-38	560 kΩ, 1/2-watt, 5%
R139	63-10244-30	270 kΩ, 1/2-watt, 5%
R141	63-10857-24	2 MΩ, control, focus
R142	63-10857-20	250 kΩ, control (master brightness)
R143	63-11028-01	250 kΩ, control (external brightness)
R146	63-10235-90	5.6 kΩ, 1/4-watt, 5%
R147	63-10246-46	1.2 MΩ, 1/2-watt, 10%
R148	63-10236-43	910 kΩ, 1/4-watt, 5%
R149	63-10244-04	22 kΩ, 1/2-watt, 5%
R150	63-10236-28	220 kΩ, 1/4-watt, 5%
R151	63-10236-05	24 kΩ, 1/4-watt, 5%
R201	63-10836-72	1k Ω, 2-watt, 5%
R202	63-10235-40	47 Ω, 1/4-watt, 5%
R204	63-10236	15 kΩ, 1/4-watt, 5%
R205	63-10235-72	1000 Ω, 1/4-watt, 5%
R206	63-07763	330 Ω, 1/2-watt, 5%
R207	63-10832-36	33 Ω, 1-watt, 5%
R208	63-07799	2.2 kΩ, 1/2-watt, 10%
R209	63-07827	10 kΩ, 1/2-watt, 10%
R211	63-07855	47 kΩ, 1/2-watt, 10%

Table 5 (continued)
Electronic Components
(Refer to Figures 4, 7, and 11)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
Resistors (Cont'd.)		
R212	63-0235-40	47 Ω, 1/4-watt, 5%
R213	63-10235-72	1 kΩ, 1/4-watt, 5%
R216	63-10235-42	56 Ω, 1/4-watt, 5%
R217	63-10235-48	100 Ω, 1/4-watt, 5%
R218	63-10235-73	1.1 kΩ, 1/4-watt, 5%
R219	63-10235-72	1 kΩ, 1/4-watt, 5%
R220	63-10235-58	270 Ω, 1/4-watt, 5%
R221	63-10235-40	47 Ω, 1/4-watt, 5%
R222	63-10235-48	100 Ω, 1/4-watt, 5%
R223	63-10235-48	100 Ω, 1/4-watt, 5%
R224	63-10235-76	1.5 kΩ, 1/4-watt, 5%
R227	63-10235-73	1.1 kΩ, 1/4-watt, 5%
R228	63-10243-52	150 Ω, 1/2-watt, 5%
R229	63-10235-75	1.3 kΩ, 1/4-watt, 5%
R232	63-10235-88	4.7 kΩ, 1/4-watt, 5%
R233	63-10235-72	1 kΩ, 1/4-watt, 5%
R236	63-10235-40	47 Ω, 1/4-watt, 5%
R301	63-10243-06	1.8 Ω, 1/2-watt, 5%
R302	63-10236-04	22 kΩ, 1/4-watt, 5%
R303	63-10236-28	220 kΩ, 1/4-watt, 5%
R304	63-10183-40	47 Ω, 1/4-watt, 10%
R306	63-10236-04	22 kΩ, 1/4-watt, 5%
R307	63-10235-90	5.6 kΩ, 1/4-watt, 5%
R308	63-10236-02	18 kΩ, 1/4-watt, 5%z
R309	63-10236-54	2.7 MΩ, 1/4-watt, 5%
R311	63-10236-54	2.7 MΩ, 1/4-watt, 5%
R312	63-09228-16	250 kΩ, control (vertical size)
R313	63-07778	680 Ω, 1/2-watt, 10%
R314	63-07768	390 Ω, 1/2-watt, 10%
R316	63-10236-08	33 kΩ, 1/4-watt, 5%
R317	63-10235-66	560 Ω, 1/4-watt, 5%
R318	63-10235-48	100 Ω, 1/4-watt, 5%
R319	63-10235-10	2.7 Ω, 1/4-watt, 5%
RX321	63-10559-32	22 Ω, 1/4-watt, 5%
R323	63-10235-90	5.6 kΩ, 1/4-watt, 5%
R324	63-10235-88	4.7 kΩ, 1/4-watt, 5%
R336	63-10235-48	100 Ω, 1/4-watt, 5%
R402	63-11028-02	500 Ω, control (contrast)
R412	63-10235-64	470 Ω, 1/4-watt, 5%

Table 5 (continued)
Electronic Components
(Refer to Figures 4, 7, and 11)

REFERENCE DESIGNATOR	ZDS PART NUMBER	DESCRIPTION
Resistors (Cont'd.)		
RX413	63-10559-12	3.3 Ω, 1/4-watt, 5%
R416	63-10235-80	2.2 kΩ, 1/4-watt, 5%
R423	63-10235-64	470 Ω, 1/4-watt, 5%
RX501	63-10836-32	22 Ω, 2-watt, 5%
RX502	63-10449-54	18 Ω, 7-watt, 5%
RX503	63-10857-12	10 kΩ, control, B + adjust
RX504	63-10832-68	680 Ω, 1-watt, 5%
RX505	63-10845	7500 Ω, 2-watt, 5% (ZVM-1240)
RX505	63-10841-02	18 kΩ, 3-watt, 5% (ZVM-1240-E)
RX506	63-10243-24	10 Ω, 1/2-watt, 5% (ZVM-1240)
RX506	63-10243-06	1.8 Ω, 1/2-watt, 5% (ZVM-1240-E)
RX507	63-07784	1 kΩ, 1/2-watt, 5%
RX508	63-10235-24	10 Ω, 1/4-watt, 5%
RX509	63-10235-84	3.3 kΩ, 1/4-watt, 5%
RX510	63-10845	15 kΩ, 5-watt, 5% (ZVM-1240)
RX510	63-10841-02	18 kΩ, 3-watt, 5% (ZVM-1240-E)
RX511	63-10236-08	33 kΩ, 1/4-watt, 5%
RX512	63-10236-04	22 kΩ, 1/4-watt, 5%
RX513	63-10235-48	100 Ω, 1/4-watt, 5%
TRANSFORMERS		
TX101	95-03136-03	Transformer, horizontal driver
TX102	95-03828	Transformer, sweep
TX202	95-03397-07	Transformer, yoke
TX501	95-03559-01	Coil, line filter
TX502	95-03891-01	Transformer, inverter (ZVM-1240)
TX502	95-03891	Transformer, chopper (ZVM-1240-E)

Waveform Photograph Explanations

The waveforms in this manual are photographs taken on a DC-coupled Tektronix 2445, 4-channel, 150 MHz oscilloscope through a 10X probe with 10 MΩ impedance. The oscilloscope automatically compensates for the 10X probe, so the display in Figure A shows the probe input.

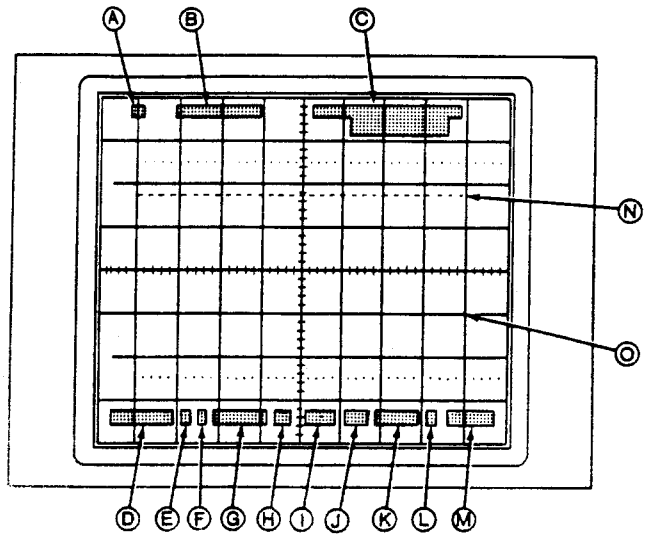


Figure A

OSCILLOSCOPE DISPLAY

A — The letter (A or B) is the oscilloscope trigger that is controlling the display. The trigger source is the second character (Channel 1, 2, 3, or 4).

B — The voltage level at which the scan is triggered, measured in volts (V) or millivolts (mV).

C — One of four possible values: sweep delay time, delta voltage, delta time, or inverse delta time (1/delta time). Delta values are established between the variable reference cursor (dotted line O) and the variable reference cursor (dashed line N). The symbol to the left of the value type indicates delta or delay, while the symbol to the right indicates unit of measurement, based upon either the sweep scale factor (See K and M) or the scale factor (See D, G, I, and J).

D — The channel 1 scale factor in volts (V) or millivolts (mV).

E — Indicates two signals summed together (+).

F — Indicates inverted display (down arrow).

G — The channel 2 scale factor in volts (V) or millivolts (mV).

H — Bandwidth limitation (20 MHz) indicator (BWL).

I — Channel 3 scale factor in volts (V) or millivolts (mV).

J — Channel 4 scale factor in volts (V) or millivolts (mV).

K — A sweep time base in seconds (s), milliseconds (ms), microseconds (μs), or nanoseconds (ns).

L — Holdoff indicator (HO). Holdoff is the amount of time between the end of the sweep and the time that a triggering signal can initiate the next sweep.

M — B-sweep time base in seconds (s), milliseconds (ms), microseconds (μs), or nanoseconds (ns).

N — Data cursor which may be varied either on the vertical axis (illustrated) to measure delta voltage or on the horizontal axis (not illustrated) to measure delta time.

O — Reference cursor which may be varied either on the vertical axis (illustrated) or on the horizontal axis (not illustrated). When in the vertical axis, this cursor indicates ground reference. A ground symbol will be shown on the photograph for exceptions.

YOUR WAVEFORM MAY LOOK DIFFERENT

Differences in oscilloscope probe ground lead length and ground lead positioning may explain why your waveform and the photographs in this manual look different.

Pickup of stray signals add to the test circuit signal, giving a distorted display and wrong peak-to-peak voltage. The stray signal is picked up in the ground lead of the oscilloscope probe. For the least pickup, keep the probe ground lead as short as possible and keep it away from strong magnetic fields.

Both photographs (Figures B and C) below show the same test circuit signal, under the same conditions except for ground lead length and positioning. The photograph taken with the short probe ground lead shows no distortion and correct peak-to-peak voltage. The photograph taken with the long probe ground lead shows distortion and an incorrect peak-to-peak voltage. (Pickup in this case is from the horizontal output transformer of a monochrome monitor).

Also, your waveforms can vary slightly from the photographs in this manual due to bandwidth, input impedance, and other oscilloscope differences, as well as the monitor being different.

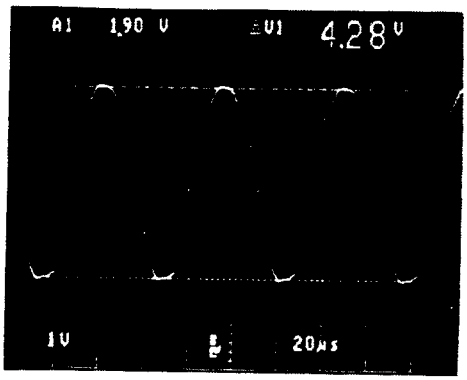


Figure B
Short Ground Lead

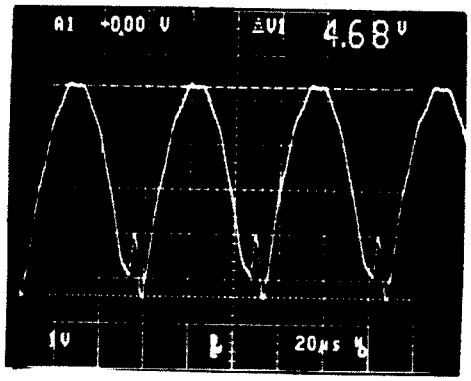


Figure C
Long Ground Lead